

DEVELOPMENT OF MARINE DIGITAL DATABASE SYSTEM FOR NAVIGATIONAL AID AT COASTAL AREA

Mohd Razali Mahmud and Noorzalianee Ghazali

Institute for Geospatial Science and Technology, Faculty of Geoinformation Science and Engineering
Universiti Teknologi Malaysia, 81310 UTM Skudai, Johor, Malaysia
Tel/Fax: 607-5530943
E-mail: razali@fksg.utm.my

Abstract

This study is part of digital integrated coastal zone management system that is still under intensive research in several agencies in Malaysia. The foundation of this research is based on some parallel activities that occur in coastal area consisting of multiple agencies with multiple tasks but with one reason that is to make sure coastal activities are consistently smooth and flawless. A serious consideration has been given during the early stage of the system development considering it will involve lots of data, and lots of formats and scales which can lead to the wrong interpretation of the data. The expectation to this system is it can provide maximum assistant to coastal users for stringent navigation in port areas during berthing and departing of the ship. Furthermore, data that contains in this database will have an availability to assist the authority while making decision regarding things that occur in the coastal area.

Keywords: database, coastal management, navigation

1.0 INTRODUCTION

Toward the growth of economic, Malaysia as one of maritime countries has invested a huge amount of money into marine development covering services, infrastructure and safety. Situated in South East Asia, Malaysia has the potential to become one of the major leaders in maritime industries based on strategic surrounding for maritime activities such as development, economics, recreations and explorations due to the economic and humanity request. Significantly, the shipping sector and coastal development also expanding positively involving many sector and people. By the rapid development in these areas, this actually can cause many consequences not only to the standard of life but also to the environmental condition. These two aspects actually have a balance relationship, damage coastal environment will decrease the quality of life but at the same time the development of the coastal can increase the standard of life to the people in that area. In order to minimize the impact of development in this particular area, one systematic method need to be develop purposing in monitoring and maintenance work. Thus, it also can be manipulated in decision making and navigational tools for local authorities or certain agencies that responsible to the critical area such as port and harbours also coastal area which under development and other potential area. This system consist an integrated approach which takes into account all sector interest and deal with economic and social issues as well as environmental and ecological issues. Besides the focus on resolving and preventing multiple use conflict, this system also carried high expectation to maximize the benefits provided by the coastal zone and to minimize the conflict and harmful effect of activities on each other.

2.0 MARINE DATABASE SYSTEM

The efficiency of Geographical Information System (GIS) in land administration has lead to the major revolution in the world of survey and mapping. Nowadays people are talking about sub-millimetre accuracy compare to centimetre in past few years. This also has an impact to hidrography / marine society. Parallel activities that happens in coastal area, principally from natural sources like tides, waves, current and wind is the main concern which have resulted in integration of multiple and

sometimes conflicting data also scenarios around the coast. This requires new approach rather than conversional method to outcome this situation. Today positioning and navigational in coastal area not only concerning about crashing into other ship, coral reef or sandbank but it is become more stringent with the existing of fibre optic cable, utility cables, gas and oil pipelines also under water indicator equipment like boomer or artificial reef. The existences of these things were traced in nautical chart also announce in notices for marines for pilot and captain attention. The question is how often the pilot or captain has to divert their attention during piloting just because they cannot remember these entire particular and have to refer to the notices. Another question that is also relevant is how often the authority (in this case IMO/IHO) need to update the nautical chart so it will always co-op well with the rapid development in marine areas. This question also lead us to ask how often the shipping company or sailing individual need to buy new nautical chart to keep up to date about particular marine areas. By considering all these circumstances so the marine communities has agreed to implement new digital navigational system Electronic Navigational Chart (ENC) and then it has been enhance to Electronic Chart Display Information System as “best alliance” to paper chart, magnetic compass, radar, gyro bearings, echo sounder, log and other traditional aids for navigation.

The capabilities of this new age of navigational system are beyond expectation because other than acting as navigational tools, it also can provide the mariner with query achievement. Thank you to GIS for invented this extremely useful system. The dynamic nature of vector data that can digest so many information will provide the mariners useful information that are needed during sailing. Compact, rough and rugged are always the first criteria while choosing the complete system containing equipment and software. Compact in the sense of information means integrated huge quantity of data in small capacity of space. Laborious or continuous click on computer system in order to achieve one command or information cannot be tolerated in stringent marine work. Data integration is the solid solution for this problem. Different data from various agencies have been compressed into one georeferencing with a serious consideration on different level of accuracy. These differences in accuracy exist even to the same type of data because of the disinteraction between the origin and the purpose of data. Integrated data not only will compact the database but also will reduce the cost from the overlapping work at same area by different agency.

During integration there are certain criteria that has been given special attention just because the data came from different sources. Multiple agencies carried the same responsibilities will ended up having same information but different hierarchy of accuracy based on their own speciality. The most obvious problem that occurs is the exact same data but was presented differently based on individual interpretation by the agency. This is caused by a different method of interpretation and also most probably because of different software which has been used. The differences are commonly about colours, coordinate system (georeferencing), symbol and legend. The ability to differentiate these kinds of differences always need a combination of knowledge and experience in mapping or cartography.

3.0 INTEGRATED COASTAL ZONE MANAGEMENT (ICZM)

Coastal Zones has attracted increase interest related to integrated management concept development and are regarded as special areas with specific characteristics. Some of the characteristics of the Coastal Zone can easily be elaborated. Coastal Zone with coastal area as a dynamic area with frequently changing biological, chemical and geological attributes. It includes highly productive and biological diverse ecosystems that offer crucial nursery and breeding areas for marine organisms, thus providing part of the basis for biological production in the sea. It also affected, through the coastal hydrodynamics by the actions of the sea (storms, coastal erosion/accretion, flooding, tsunamis etc.). Other than that, coastal areas are linked with and dependent on the mechanics of the sea, such as the hydraulic movements in rivers and the underground water tables. Other than nature ecosystem, coastal area is an area of high economic significance, which is often subject to fast economic development, large population migrations and urban development. The coast's attraction to human settlements is amongst others due to its proximity to the oceans' living and non-living resources, as

well as marine transportation and recreation. This make coastal areas also act as a barrier for land-based pollution and discharges to the sea impacting the environmental quality of these areas, in particular in relation to urban developments along the coastlines and in relation to river catchments development effecting estuarine areas.

4.0 FRAME

The entire systems rely on windows operation that can be used both on laptop and PDA and of course computer. As a database system, the capability to store, save and provide the information to user is the highest priority. All other capabilities will depend on data and information that can be provided by the mainframe. Considering the main purpose of this research is to enhance the existing database in the sense of capability and effectiveness, there are two levels of module that has been created. The first level is the main frame that was built with large storage compartment and is capable to provide custom analysis. Using GIS software ArcGIS 8.1, the mainframe is not only for keeping data but also can generate new data that is more specific for sub module. The generation of new data might come out from analysis that has been generated from raw data or any level of data analysis. In this case, thematic map is something that only takes less than few hours to produce. The second level will be the sub modules that rely on the mainframe database to work properly but not necessarily to have the whole main database to function correctly. Visual basic programming plus Microsoft Office Applications make all sub modules just like what the field operator needed. For navigation by PDA, software ArcPad can converse perfectly with the database as well as the other navigational software that can accept DXF, DWG and shape file as the base map.

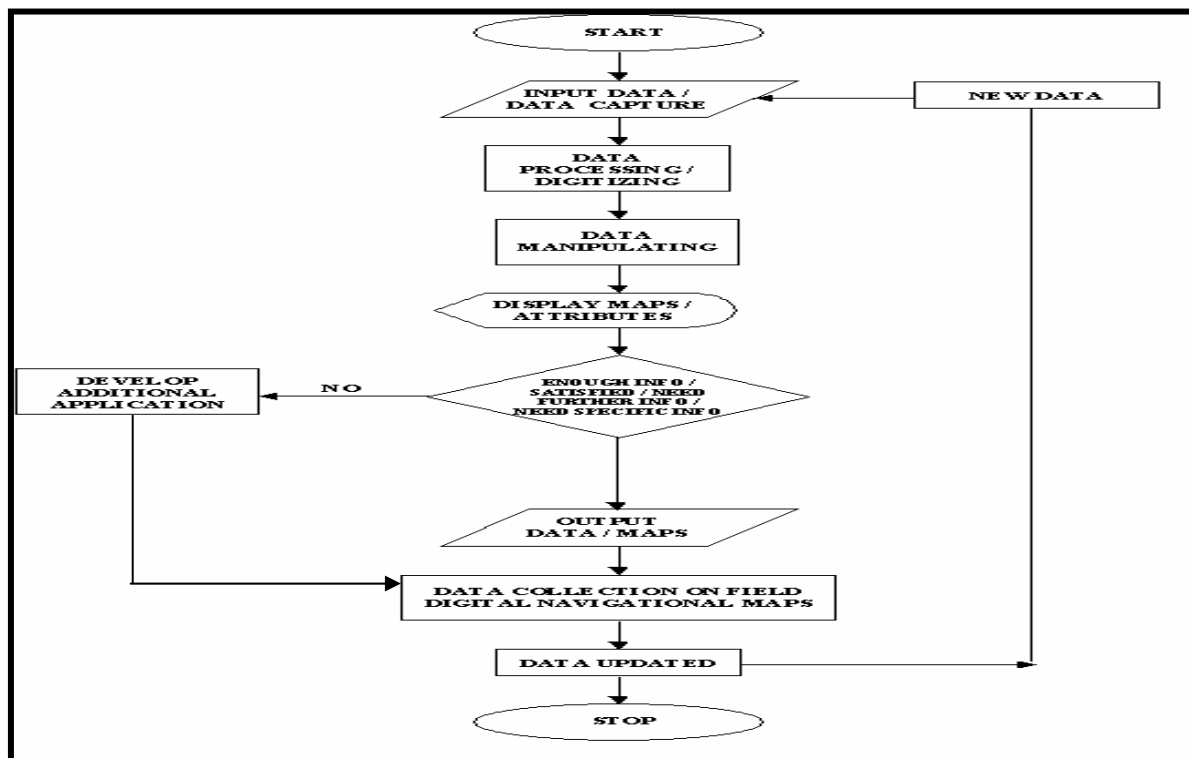


Figure 1: System Main Frame

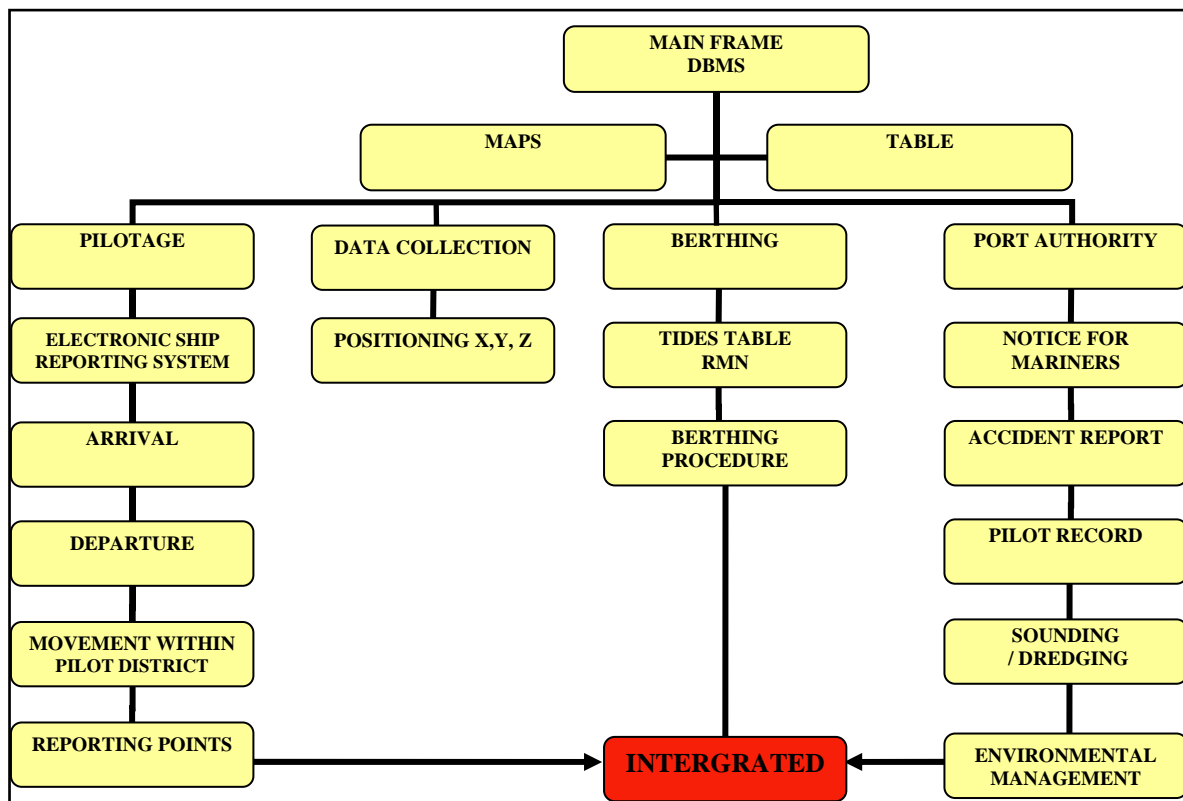


Figure 2: System Sub Modules

5.0 SYSTEM

The development of this system has been compliance with several agencies that are involved in port management. For benchmarking, Port Klang has been chosen as the project area. All the data are within four ports that are located in Port Klang. Northport, Westport, Starcruise terminal and Southport and will be connected into each other in one integrated database. The main issue regarding integrated database is security. Data sharing will give access to lots of party that represent various agencies. Even with the limitation like read only or for display only, the data can still be altered or manipulated in many ways. To prevent this, hierarchy password access has been implanted. Certain password will have full access to all data and capable to make alteration in mother database from mainframe. The other password will have limitation in data accessing. For example, port operator can access pilotage and berthing sub module only but they cannot access data collection and port authority sub module. The derivation of mainframe in order to extract sub module into different platform is still under consideration of the highest hierarchy password holder.

Present pilotage within port area that do not compromise with unfamiliarity on that particular area soon can be challenged with the implementation of this system. Sub module pilotage and berthing that has been extracted to light platform like PDA can easily be carried into ship by port pilot. Alarming capabilities will remind the pilot once they reach reporting points, other than that, the pilot will also be reminded with certain specific order that has been install earlier in sub module by port operator. However, this ability still requires more precise research, stimulation and on ground testing before it can be implemented as primary port area navigation guidance.

The benchmarking of this system will consist of two major aspect; effectiveness and accuracy. The effectiveness of this system depends on the capabilities to provide all requirements that are needed by the users. Started with topography map as base maps, then nautical chart and bathymetry plan were added plus other spatial and attribute data until it forms the complete database about that particular area. The module and sub module are based on existing system with several enhancement originally suggested by those that operates the existing system. For accuracy, the benchmarking will be justified with the level of accuracy that can be achieved by positioning equipment. More accurate equipment will result on better accuracy for the system because the system will only accept that position that is acquire from positioning tools. Other than that, the accuracy is also been benchmark with the level of precision in spatial and attribute data that is integrated in database. This is the art of cartography which requires experience and sharp skill in order to interpret lots of data before integrate it back in one database. The level of resolution that can be achieved by this system solely depends on the acquisition accuracy derived from the data during pre operation and equipment while operating.

6.0 CONCLUSION

As the early version of the system, there are certain part that still under considerations and reconstructions. The enhancement that has been implant into this system is the result from the feedback by several system operators based on their experience in operating the existing system. More stimulation and on ground testing is needed to make sure the system can really fulfils all the compulsory restriction in marine operation especially in port and coastal area. Upon completion, this system will cover the operation within the land-based only and not ship-based. Perhaps the extension of this study will include the ship-based operation and finally forming the complete integrated system covering land and ship operation in one interactive system.

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